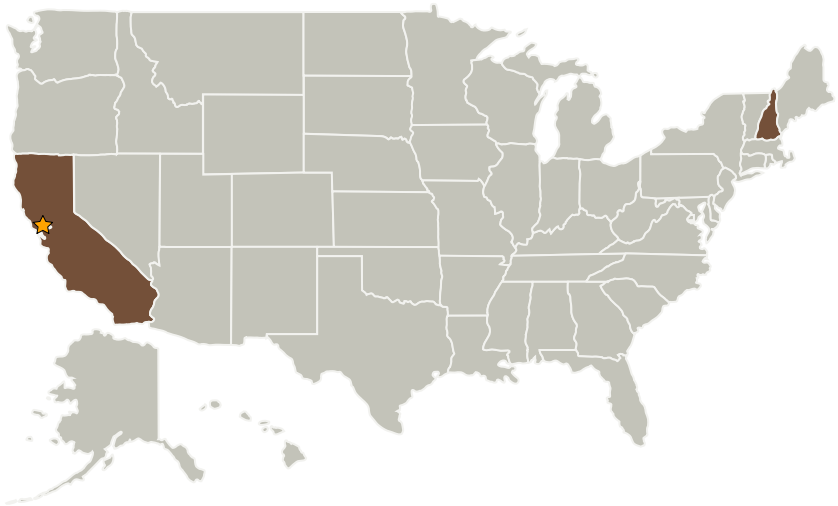
Advanced, Long-Life Cryocooler Technology for Zero-Boil-Off Cryogen Storage, Phase II

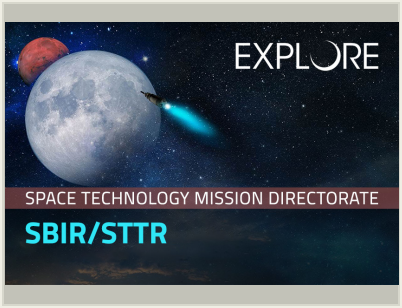
Completed Technology Project (2009 - 2011)

Project Introduction

Long-life, high-capacity cryocoolers are a critical need for future space systems utilizing stored cryogens. The cooling requirements for planetary and extraterrestrial exploration missions, Crew Exploration Vehicles, extended-life orbital transfer vehicles, and space depots will range from 10 to 50 W at temperatures between 20 and 120 K. Turbo-Brayton cryocoolers are ideal for these systems because they are lightweight, compact and very efficient at high cooling loads, in addition to their inherent attributes of high reliability; negligible vibration; long, maintenance-free lifetimes; and flexibility in integrating with spacecraft systems and payloads. To date, space-borne turbo-Brayton technology has been developed for modest cooling loads. During the proposed program, Creare will develop an advanced, high efficiency turbine optimized for a high-capacity cryocooler. The advanced turbine will enable a landmark reduction in cryocooler input power and overall cooling system mass. In Phase I, we defined the cryocooler requirements for a particular mission class, developed the conceptual design of a multistage cryocooler to meet the requirements, developed the preliminary design of the advanced turbine and successfully performed proof-of-concept tests on the turbine. During Phase II, we will fabricate the turbine optimized to provide 5-20 W of net refrigeration at 20 K and demonstrate its performance at prototypical operating conditions.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Ames Research Center (ARC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
Creare LLC	Supporting Organization	Industry	Hanover, New Hampshire

Primary U.S. Work Locations	
California	New Hampshire

Project Transitions

February 2009: Project Start

September 2011: Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors